Software Reuse Practices Within the Earth Science Community

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ESDS Reuse Working Group

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The Earth Sciences software development community is often challenged to provide cost effective, highly reliable and easy-to-use software to achieve scientific missions. In the process, the Earth science community spends a significant amount of resources developing software components and other software development artifacts that may also be of value if reused in other projects requiring similar functionality. Indeed, the software engineering literature cites many case studies where reusing existing software artifacts has improved productivity and quality while reducing system development cost and schedule. However, realizing such benefits for Earth science data systems has been challenging due to the scale, complexity, heterogeneity and distributed nature of these systems, which often are constructed and operated by a mix of government, industry and academic organizations. Although new generations of the more complex systems often exploit domain knowledge and expertise from previous development activities, a more disciplined reuse approach is still needed to further assist with cost reduction and productivity improvement within the Earth science community. A recent survey performed the by the NASA Earth Science Data Systems Reuse Working Group examined current reuse practices within the Earth science community and community opinions on various approaches to facilitating software reuse. In this presentation, we present the findings of the study and put forward suggestions for increasing reuse and improving collaboration within the Earth science software development community.

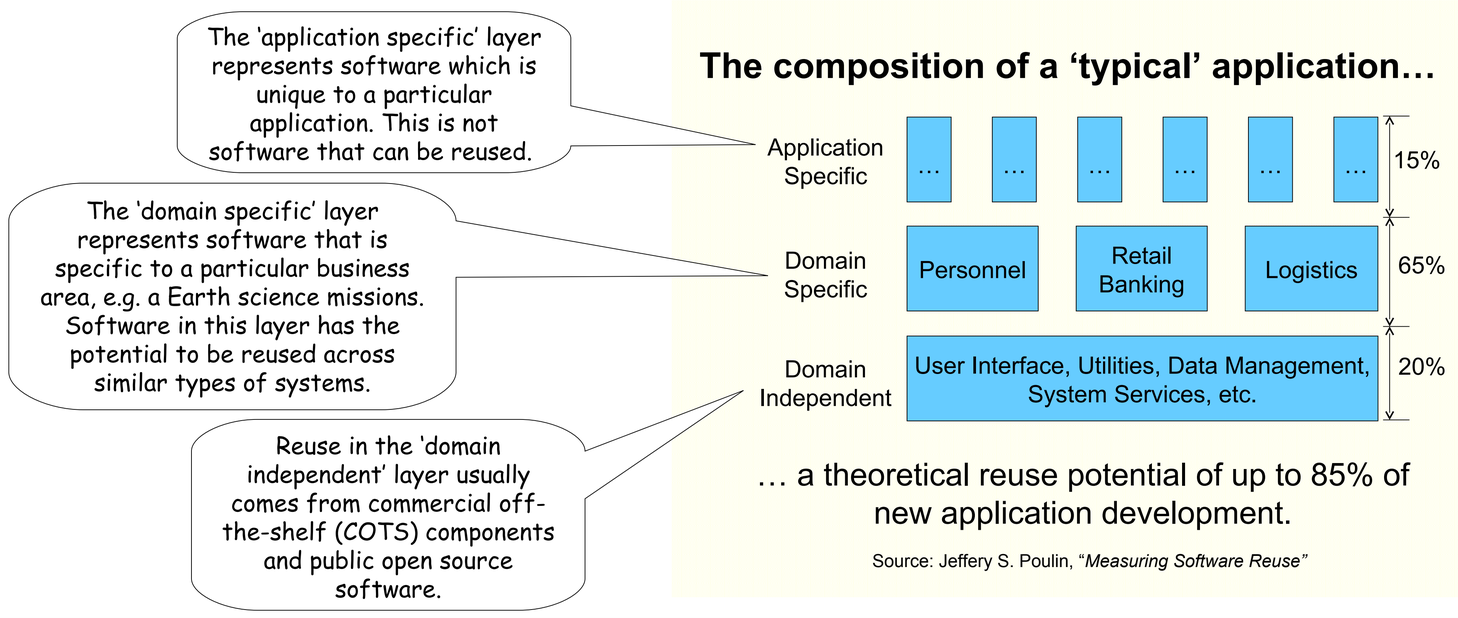
Software reuse is the process of implementing or updating software systems using pre-existing software assets

Reusable assets can be from any part of the software development life cycle including: software components, objects, software requirement analysis and design models, domain architectures, database schemas, code documentation, test scenarios, and plans

Expected Benefits of Reuse

- Lower development costs
- Higher productivity; better use of resources
- Reduce cycle time; quicker development
- Lower training costs
- Easier maintenance
- Higher quality
- Lower risk
- Better interoperability

The composition of a 'typical' application…

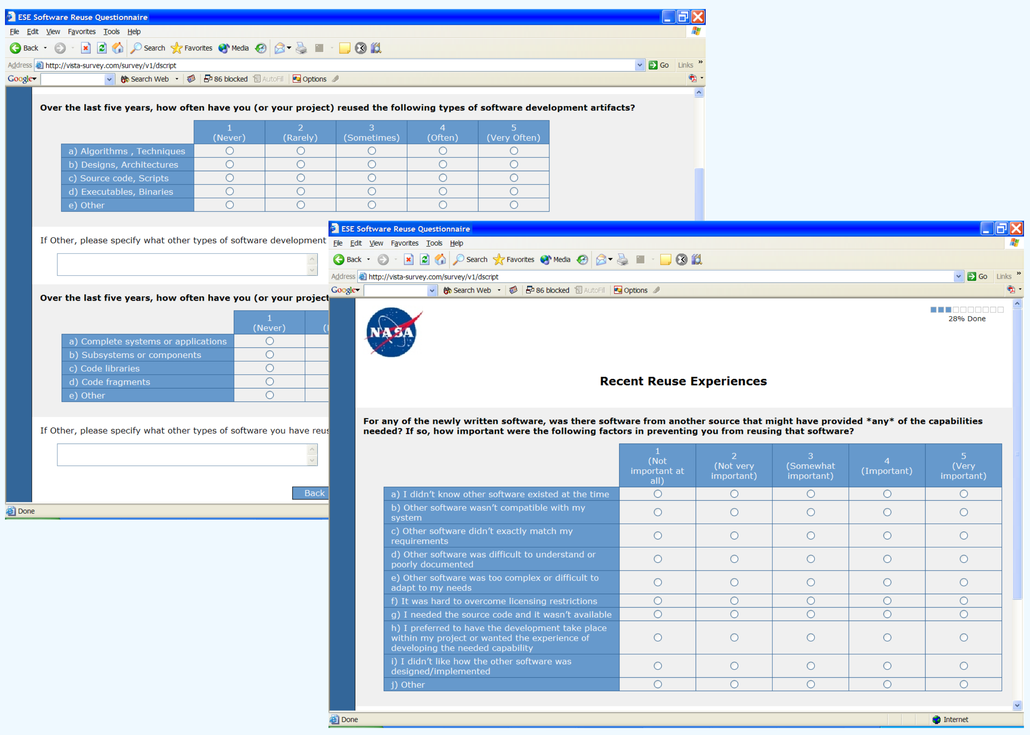


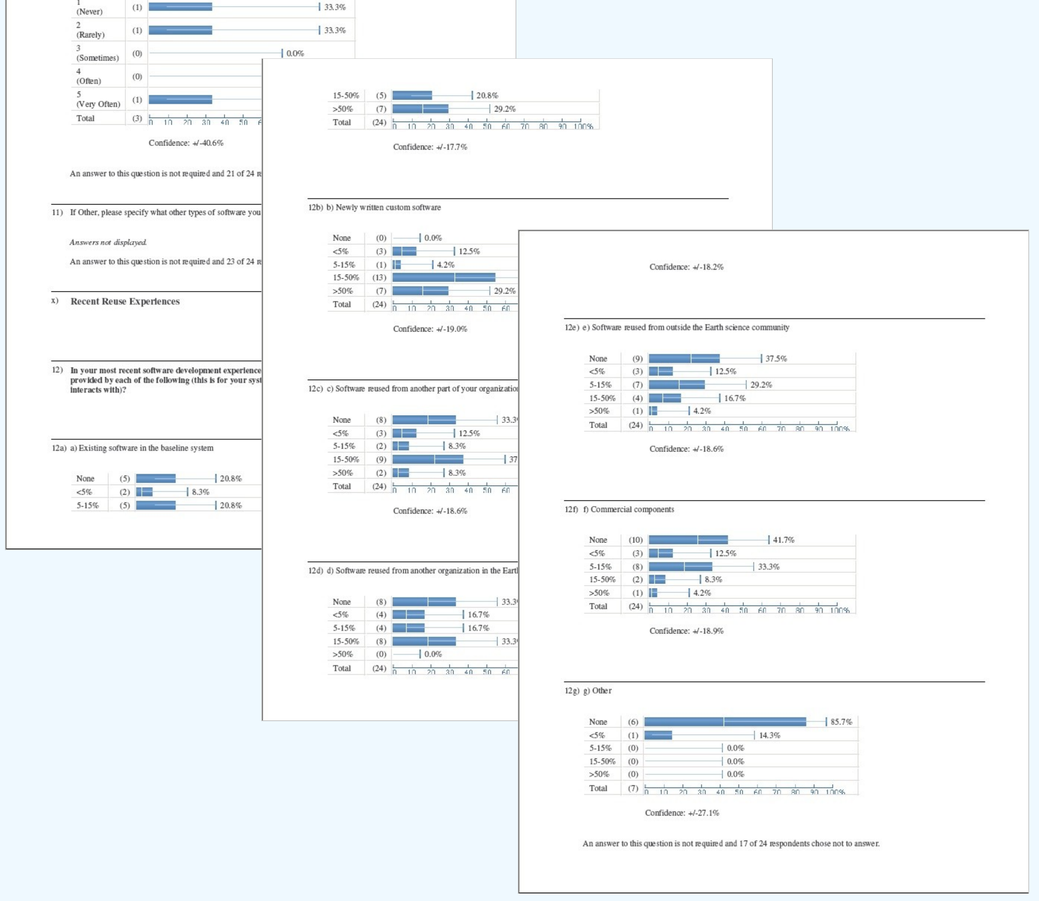
… a theoretical reuse potential of up to 85% of new application development.

Source: Jeffery S. Poulin, "*Measuring Software Reuse*"

Survey conducted to establish reuse practices and needs of the Earth science community

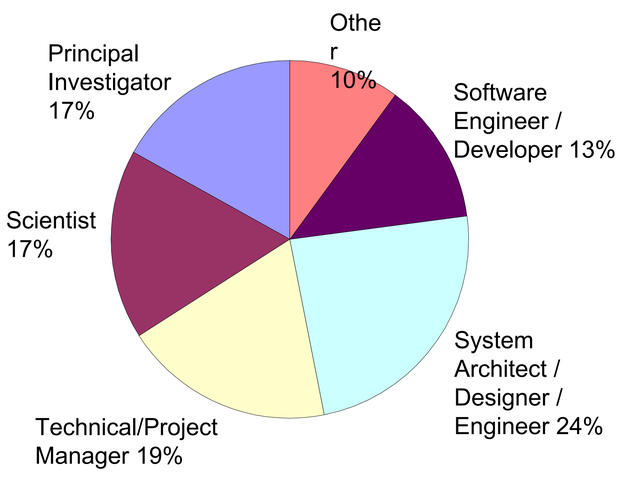
OMB approval obtained 01/04/2005 (Approval No.: 2700-0117)
Used Web-based survey tool (Vanguard Vista) to simplify response submission and data collection
Approximately 3000 invitations issued -100 responses



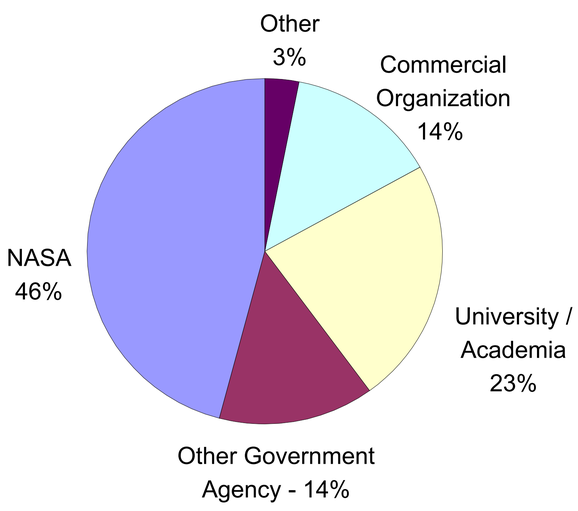


Reuse Survey – Community Profile

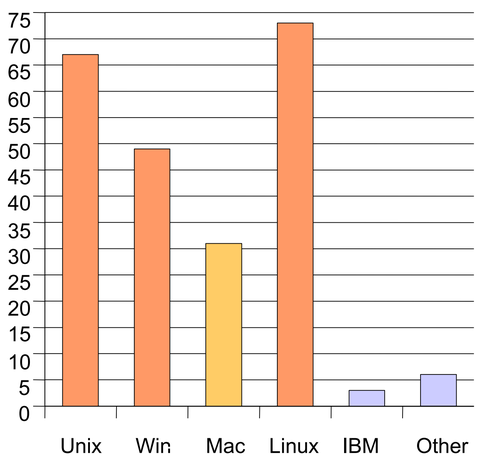
Which of the following best describes your main role in your project/software development process?



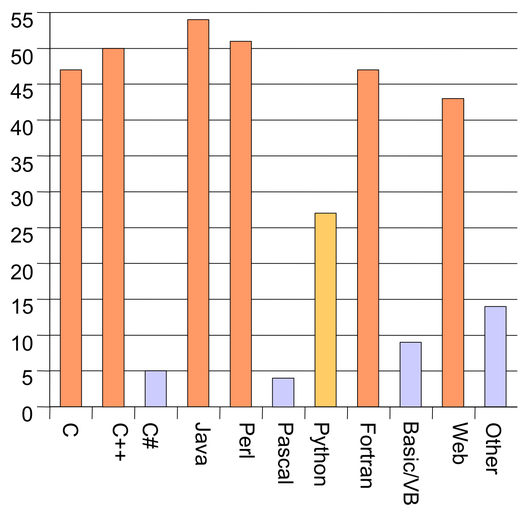
Which category best describes the type of your organization?



Which Operating System(s) do you currently use or plan to use… ?



Which programming language(s) do you currently use or plan to use… ?



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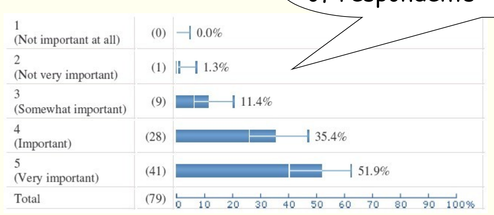
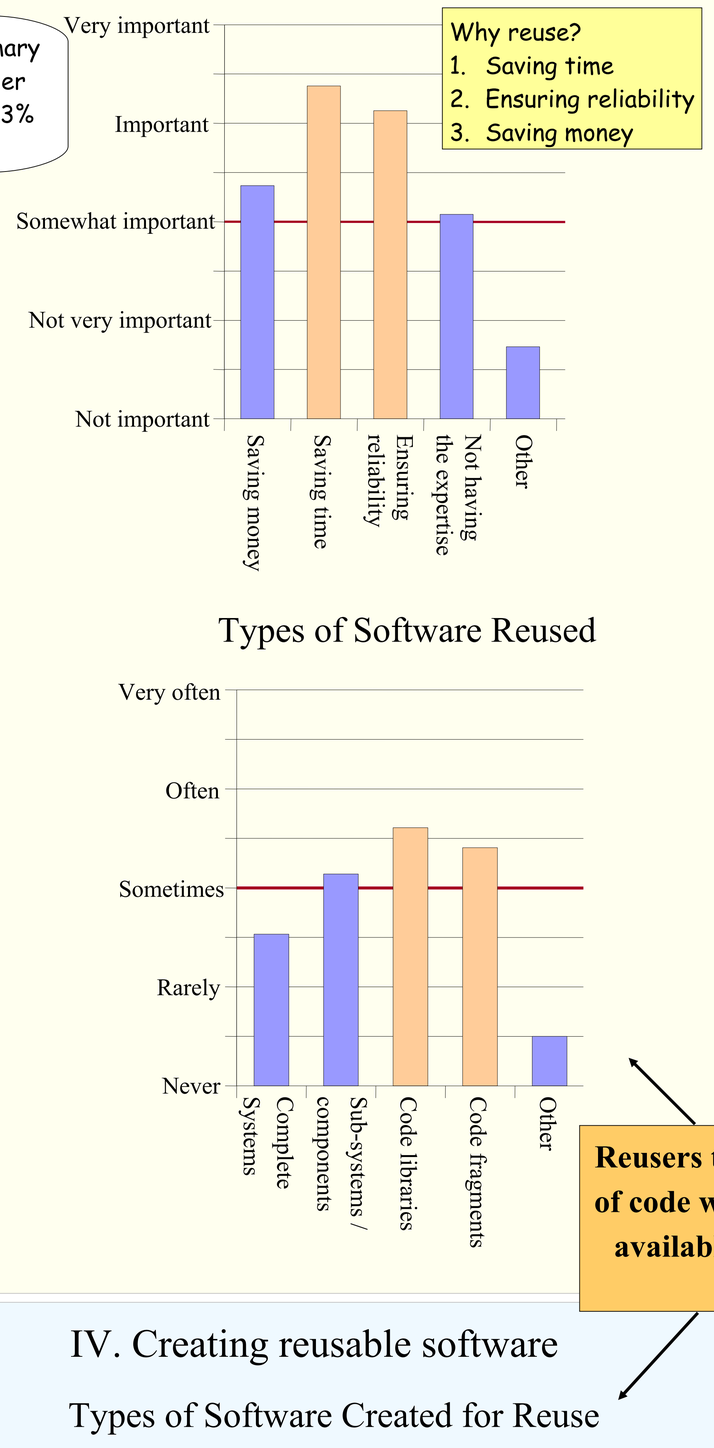
Survey Results and Conclusions

I. Reuse Experiences

Saving time was ranked as the primary motivation for reuse. Rated as either important or very important by 87.3% of respondents

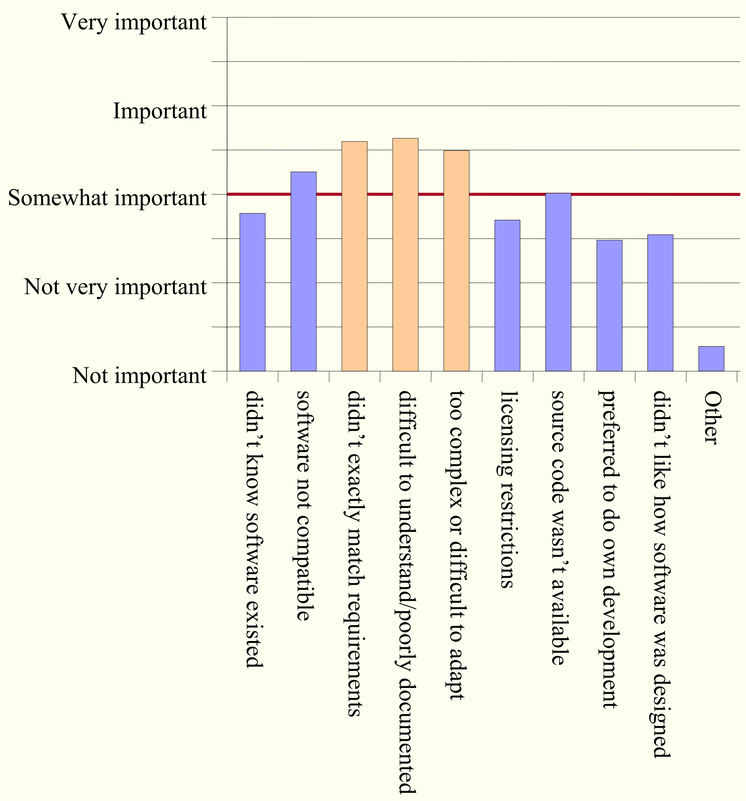


Motivation For Reuse



Why reuse?
1. Saving time
2. Ensuring reliability
3. Saving money

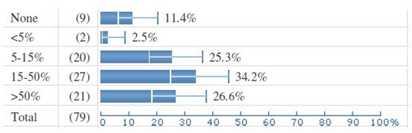
Barriers to Reusing Software



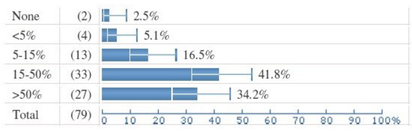
Types of Software Reused

II. Software Functionality Sources

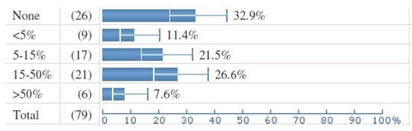
Existing software in the baseline system



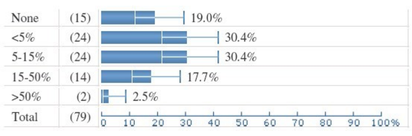
Newly written custom software



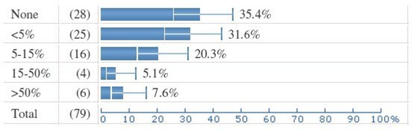
Software reused from another part of your organization



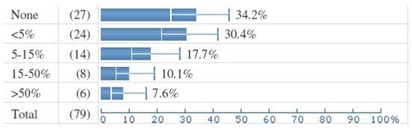
Software reused from another organization in the Earth science community



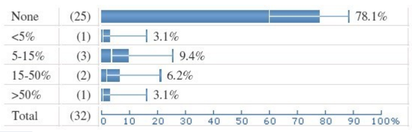
Software reused from outside the Earth science community



Commercial components



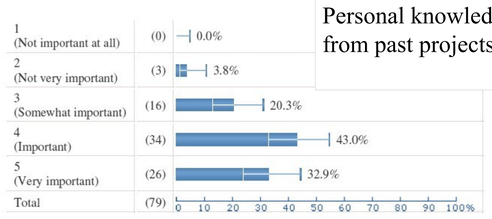
Other



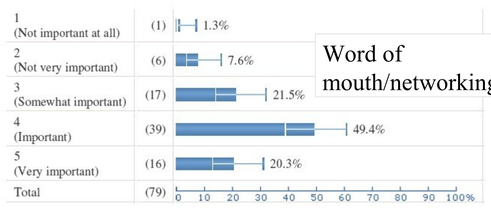
Reusers tend to favor the smaller units of code while the software that is made available for reuse is more often the larger units of code

III. Locating reusable software development artifacts

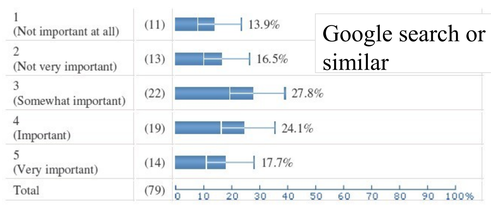
Personal knowledge from past projects



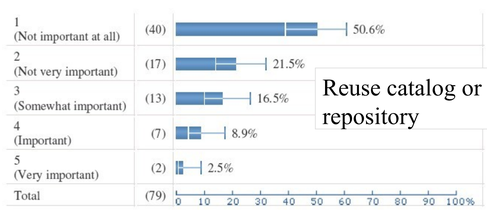
Word of mouth/networking



Google search or similar

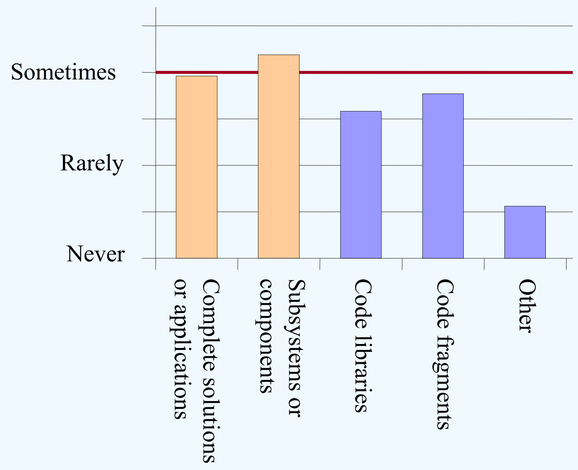


Reuse catalog or repository

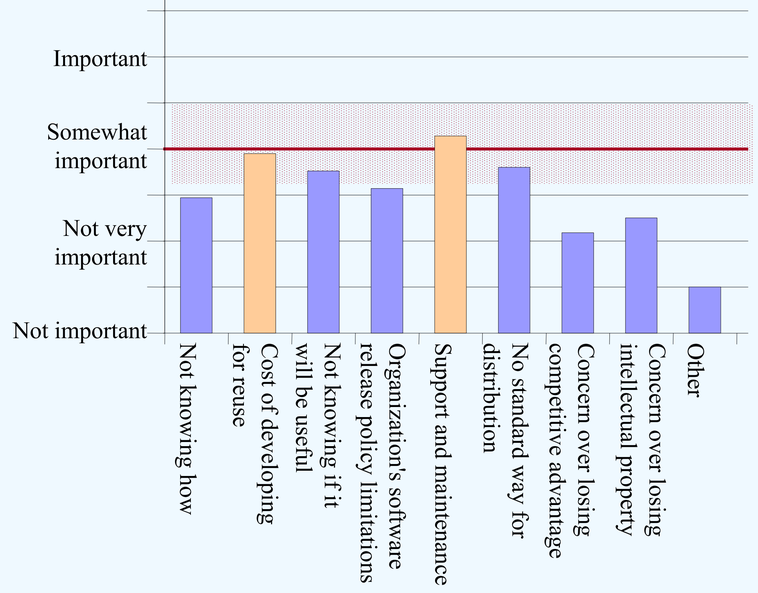


IV. Creating reusable software

Types of Software Created for Reuse

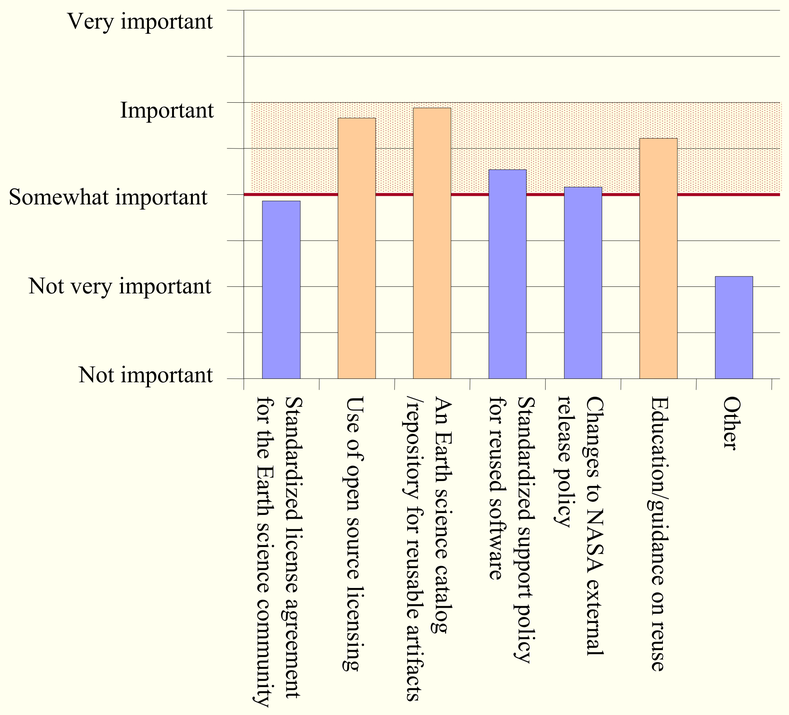


Barriers to Making Software Available for Reuse



V. Increasing Software Reuse in the Earth Science Community

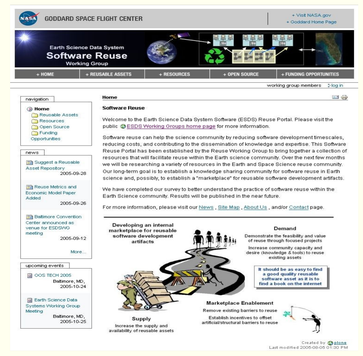
How to Increase Reuse



Greater use of open source licensing, a repository for Earth science artifacts, and education and guidance on reuse were identified as the most important factors in increasing the amount of reuse.

The Earth Science Data Systems Reuse Working Group has establish a pilot reuse portal to:

- Raise awareness of software reuse within the Earth science community,
- Establish a platform for community members to share/exchange resources with each other,
- Be the gateway for reuse information relevant to the community,
- Make access to reuse resources easier, and
- Become the major starting site for reuse within the community



http://softwarereuse.nasa.gov/

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